POLICY FORUM

FOREST MANAGEMENT

Collaborations and capacities to transform fire management

Progress requires attention to governance at multiple levels

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Wildfires bring stark attention to interactions among climate change, fire, forests, and livelihoods, prompting urgent calls for change from policy-makers and the public. Management options vary, but in many fire-adapted forests, the message from the scientific community is clear: Adapt to living with fire, reduce fuels and homes in the wildland-urban interface (WUI), and strategically restore fire to ecosystems (*1*–*4*). Yet, changes to fire management outcomes have been elusive. For example, across the primarily public forestlands of the U.S. West, prescribed fires (intentionally lighted fires) constitute a small, inadequate fraction of forest treatments (*5*), and fire managers rapidly contain over 95% of ignitions (*2*). Meanwhile, the WUI is the fastest growing U.S. land-use type (*6*). Substantial land-use changes that remove people and infrastructure from fire-prone areas are unlikely, making forest management a critical piece of the puzzle. To inform the global challenge of living with fire, we discuss promising developments in U.S. federal fire management that rely on collaborative governance, which is essential for grappling with complex environmental management challenges to leverage diverse capacities, work across jurisdictions, and support collective action to plan for the long term in the face of pressures to focus on short-term risks and objectives.

In the western United States and globally, fire seasons have grown longer; fire size, severity, and frequency have increased; and there has been an increase in costs and losses of human life and infrastructure (*1*, *2*). Scientists say that we must restore fire to fire-adapted forest ecosystems in order to reduce fire hazard, promote resilience, and support climate adaptation (*2*–*4*). U.S. forest restoration in fire-prone ecosystems typically involves mechanical fuel reduction (thinning of trees and clearing of brush), prescribed fire (see the photo), and/or the management of natural ignitions to reintroduce fire. Although fires historically burned under a range of conditions, they have been mostly suppressed when possible in the U.S. West for the past century, excluding low- to moderate-severity fire and perpetuating a fire debt on the landscape. Understandably, there is social and political pressure to put fires out quickly to minimize risks to human health and economic well-being (such as for the tourism industry) and to protect homes and other infrastructure. Risks of allowing fire to burn are apparent in the short term, whereas benefits of supporting fire (and downsides of exacerbating fire hazard by suppressing fire or failing to conduct prescribed fire) often accrue after the tenure of any given politician or land manager.

This situation is exacerbated by conflicting policy mandates within and across governance levels and jurisdictions. For example, the Oregon Department of Forestry has a policy of putting out fires as quickly as possible to protect timber resources. This is at odds, partially, with federal policy, which emphasizes both restoring fire to ecosystems and suppressing fire when necessary (*7*). The complexity of both our political system and the fire problem make it unlikely that policy conflicts will be resolved, although some policy reform has occurred. The National Cohesive Wildland Fire Management Strategy (mandated by Congress in 2009 and finalized in 2014) and 2012 revisions of the National Forest Management Act regulations both emphasize the importance of restoring fire (*7*). In 2016, Clean Air Act regulations were revised through collaboration among the U.S. Environmental Protection Agency and federal land management agencies to create more opportunity for prescribed fire by increasing flexibility around air-quality permitting, something that scientists have suggested is necessary to support more prescribed fire, although evidence is mixed (*3*, *8*). But simply having facilitative policies in place is not enough. Progress requires coordination across sectors (such as air quality and land management), diverse actors, and multiple levels and jurisdictions.

PROMISING DEVELOPMENTS

Both the Collaborative Forest Landscape Restoration Program (CFLRP; created by Congress in 2009 for work on National Forest System lands) and the Joint Chiefs Landscape Restoration Partnership (a similar but smaller-scale, internal agency initiative that began in 2014 to support work across both National Forests and private forestlands) represent a new model of U.S. land management policy meant to facilitate a more strategic approach to forest restoration. The programs are distinct in supporting a national process for prioritizing funding, which is important to focus investment of limited resources.

Under these programs, the U.S. Forest Service and Natural Resource Conversation Service allocate funding for mechanical thinning, prescribed fire, and other restoration activities on the basis of science-based proposals that outline the ecological, social, and economic needs and opportunities in contiguous landscapes. Proposals are written collaboratively by state and federal land managers, scientists, community-based groups, and other nongovernmental organizations and are evaluated by a national committee. The programs offer multiyear funding commitments, which buffer against

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The Geronimo Interagency Hotshot Crew from the Bureau of Indian Affairs, San Carlos Agency, conducts a prescribed burn near Galice, Oregon, in August 2013.

fluctuations and uncertainties of annual appropriations, support a coherent program of work in a landscape, and draw in partners to leverage capacity. Both programs outline substantive goals (for example, reducing fire hazard and restoring fire-adapted ecosystems while engaging industry partners) but allow flexibility to tailor projects to local capacities, socioeconomic conditions, and ecological objectives (for example, focusing on a municipal watershed versus restoring fire to an entire ecosystem).

Although not every project has been successful, program-wide these approaches support larger-scale planning and implementation of mechanical thinning of forests, innovations in monitoring and planning, leveraging of nonfederal capacity, and agreement-building in an arena that historically has been characterized by conflict over approaches to vegetation management (*9*). At the same time, major challenges persist, including inadequate agency capacity for planning and implementation, insufficient capacity in forestry-products industry, and limited markets for wood products (such as chips, pellets, firewood, and lumber) that could offset high treatment costs. Approaches that invest in places where collaboration exists also may leave behind communities without capacity, making it critical to address how to build capacity where it does not already exist.

Despite these gains, it has been challenging to implement prescribed fire without addressing barriers elsewhere in the system. Prescribed fire requires planning and permitting, is logistically complicated to execute (requiring trained staff and equipment to be available during narrow burn windows), and can be controversial. To overcome these hurdles, federal and state land managers and air-quality regulators have emphasized that in addition to leveraging local capacity, state-level interagency collaboration, because of the role of state regulatory and land management agencies, is key for facilitating communication, resource sharing, and problem solving (*8*).

For example, the Montana-Idaho Airshed Group uses an online platform to track and prioritize burns, coordinates burners within airsheds, identifies priorities for burning according to the need and availability of burn windows, and uses a liaison who works on behalf of burners to communicate with state air-quality regulators. In California, the Fire MOU (Memorandum of Understanding) Partnership brings together scientists; nonprofit, community-based, and tribal organizations; federal and state fire and land managers; and state air-quality regulators. The Partnership and other statewide institutions have helped land managers work to address air regulators' concerns with regard to managing pollutants to protect human health, allowed regulators to better understand benefits of prescribed fire and commit to increasing permitted acres, and identified barriers to burning (such as failure to use available burn days, often because of lack of capacity) and possible solutions (such as improved communication and monitoring to find space to burn without violating air-quality standards).

Similar venues exist or are emerging in other states. Improved resource-sharing tools and increased funding and human resource capacity, perhaps dedicated teams, also are needed, along with consistent direction, support, and incentives from Congress and agency leadership to indicate that prescribed fire is a priority, given that state and federal policies focus on an array of goals that may compete with increasing the presence of fire on the landscape (*8*).

To build capacity and support collaboration, states are increasing resources for fuels and fire management. For example, California is dedicating substantial funding, largely revenue from the state's carbon market, to fund teams to work across jurisdictions to remove fuels mechanically and with prescribed fire. New Mexico has appropriated funding to address fire hazard and created a working group on prescribed fire. Oregon has taken similar steps through its Federal Forest Restoration Program. Facing declining federal investments and the cross-jurisdictional nature of fire hazard, state and local governments need to act.

The U.S. Forest Service is investing in collaborative, preseason, and cross-boundary planning for fire response. Using principles of risk management and new analytical tools that use machine learning to identify potential fire control locations (*10*), managers of U.S. National Forests—engaging with nongovernmental partners, tribes, state and local agencies, and agency scientists—are determining fire management options in advance of ignitions: priorities for suppression or options to allow natural fires to burn when they may have benefits for valued resources (*11*). These activities hold promise for getting more "good" fire on the ground because changes in practice will be elusive until multiple actors build agreement about fire management approaches outside of the emergency management context and can speak to collective goals during fire events.

OPPORTUNITIES FOR POLICY-MAKERS

To support collaboration and the use of partner capacity, Congress should maintain and fully fund programs such as the CFLRP, using it as a model for future policy development (for example, a program geared toward cross-boundary prescribed fire implementation). Congress and federal agencies should consider whether the Joint Chiefs Partnership should be estab-

lished as a permanent program. Congress could improve and create grant opportunities for state agencies, tribes, and community-based groups, which would enhance their ability to add capacity and advance solutions tailored to local conditions. For example, organizations such as The Nature Conservancy and the Forest Stewards Guild have been supporting collaborations and building capacity for forest restoration (for example, as part of efforts such as the Western Klamath Restoration Partnership, the Rio Grande Water Fund, and the Prescribed Fire Training Exchange, a nationwide program that builds capacity to conduct prescribed fire). Engagement with the forest products industry is important because difficult economics have slowed progress for restoration and kept treatment costs high (*9*). Policy-makers might request the Government Accountability Office to investigate challenges faced by existing and potential industry partners and to identify possible solutions.

States can build capacity to manage fire in partnership with federal agencies by increasing state funding for restoration work across jurisdictions, investing in air-quality agency monitoring and permitting for fire management, dedicating staff to participate in collaborations, and increasing funding and direction to state forestry agencies to create a larger prescribed fire and forest restoration workforce. State policy leaders can support creation of collaborative venues such as the California Fire MOU Partnership or governors' task forces to address place-specific challenges and identify solutions. States may need to address whether the mandates of their forestry agencies or smoke management plans need updating in the face of a growing presence of fire. With the Forest Service's current emphasis on shared stewardship, there could be new opportunities for state-level leadership.

To increase capacity, Congress and land-management agencies must dedicate more funding to forest restoration and prescribed fire implementation. As a result of the rising cost of fire, the majority of the U.S. Forest Service's budget goes to fire response and suppression. The consequence is that over the past 20 years, funding for fuels reduction has not scaled with the scope of the problem, and funding and personnel have declined substantially for everything else that the agency does (*12*). Although private-sector contracting and partnerships with nongovernmental organizations have increased, it has not made up for the loss of agency capacity. Addressing the agency's ballooning fire suppression costs through the Consolidated Appropriations Act of 2018 was part of the solution. Now, Congress has the opportunity to increase the U.S. Forest Service's appropriations to fund restoration work.

Congress should continue using its oversight role to understand barriers and opportunities for change. Congress is now requiring greater information around cost drivers and decision-making in wildland fire management and the effectiveness of fuel treatments. Other challenges also need investigation; for example, fuel treatments are not always placed strategically or maintained in a way that affects fire behavior and management (*13*). Additional oversight questions could include, is the U.S. Forest Service using all scientific tools and policy options to improve strategic planning, access existing capacity, and track resource use? How is the agency capitalizing on opportunities to create and maintain desired conditions in locations that have burned or that have been treated or where natural ignitions could be managed to reintroduce fire? What more can be clarified about challenges and opportunities related to the pace of work? The Forest Service and Trump administration argue for reducing requirements around environmental impact assessment to accelerate planning, yet there is a substantial backlog of planned-but-untreated acres. And, how does the executive branch's current direction to focus on timber output square with the importance of restoring forest resilience and addressing fire hazard on federal lands?

Ongoing oversight and problem solving relies on partner engagement and scientific research. Problematically, the largest federal funding source for applied fire research (including our work) has been cut. Funding for the Joint Fire Science Program, by which interagency leadership sets priorities for much-needed ecological and social science research on fire management, should be restored at fully authorized levels.

Agencies have opportunities for internal adjustments. The U.S. Forest Service is the largest forest and fire management organization in the country and faces steadily declining resources, increased fire costs, and greater expectations for land management. These expectations are not commensurate with funding or staffing structures, necessitating a new model. The agency could consider, for example, whether seasonal hiring practices need to be adjusted to capitalize on burn windows throughout the year; address whether there is need for a dedicated prescribed fire workforce; and limit leadership turnover and vacancies, which are problematic for long-term collaboration. Scientists have made other suggestions: Integrate strategic fire management planning more thoroughly into land-management planning (*3*, *7*, *11*); create national agreements between land-management agencies to streamline resource sharing (*8*); and improve leadership direction and performance measurement to incentivize the application of fire, improve accountability during fire response, focus efforts on high-priority acres for restoration treatments, and ensure that multiple-entry treatments (such as following mechanical thinning with prescribed fire) take place to capitalize on prior investments (*3*, *7*, *11*).

Lessons from the U.S. West can be extended to other contexts and inform the global challenge of living with fire. Multiyear funding commitments and laws and policies that support collaboration within and across governance levels, facilitate capacity building and resource sharing, and include objectives that can be adapted to local conditions through participatory processes are all policy approaches that can promote collective action in a multilevel system. Collaborative governance is important at all system levels and for all aspects of fire management, including building fire-adapted communities, given the implications of fire for health, safety, housing, and growth and collaboration's central role in promoting effective community response to disturbances and disasters (*14*, *15*). Solutions that embrace and navigate this complexity have the potential to improve fire management by building the governance processes and capacities necessary to translate policy goals into action. ■

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ACKNOWLEDGMENTS

We thank our collaborators H. Huber-Stearns, S. McCaffrey, M. Thompson, and Z. Wurtzebach for their contributions to our research and thinking. We also thank anonymous reviewers and A. Agrawal, P. Duffy, R. Gruby, L. Silva, and T. Steelman for helpful reviews of earlier drafts of this article. **Funding:** This work was supported by Joint Fire Science Program 10 (16-1-02-8); C.A.S. also was supported by the National Science Foundation under grant 1702676.

10.1126/science.aay3727

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Science **366** (6461), 38-40.
DOI: 10.1126/science.aay3727